

AMENDMENTS TO THE CLAIMS

This listing of claims replaces all prior versions and listings in this application.

Listing of Claims

Claim 1 (currently amended): An apparatus for treating a wastewater comprising:
a gas-enrichment assembly adapted to receive the wastewater and a treatment gas, wherein the gas-enrichment assembly is configured to generate a gas-enriched fluid; and
a delivery assembly coupled to the gas-enrichment assembly for receiving the gas-enriched fluid from the gas-enrichment assembly and in a fluid communication with the wastewater, the delivery assembly expelling the gas-enriched fluid in a substantially bubble-free manner into the wastewater and capable of raising the concentration of the treatment gas in the wastewater to hyperbaric levels.

Claim 2 (withdrawn): The apparatus of claim 1, wherein the wastewater comprises municipal reservoir water.

Claim 3 (withdrawn): The apparatus of claim 1, wherein the wastewater comprises industrial waste.

Claim 4 (withdrawn): The apparatus of claim 1, wherein the wastewater comprises lake/pond water.

Claim 5 (withdrawn): The apparatus of claim 1, wherein the wastewater comprises river/stream water.

Claim 6 (withdrawn): The apparatus of claim 1, wherein the wastewater comprises sewage.

Claim 7 (withdrawn): The apparatus of claim 1, wherein the wastewater comprises stormwater runoff.

Claim 8 (withdrawn): The apparatus of claim 1, wherein the wastewater comprises ground water.

Claim 9 (withdrawn): The apparatus of claim 1, wherein the wastewater comprises aquacultural waters.

Claim 10 (withdrawn): The apparatus of claim 1, wherein the wastewater comprises marine hatchery waters.

Claim 11 (withdrawn): The apparatus of claim 1, wherein the wastewater comprises agricultural waste.

Claim 12 (withdrawn): The apparatus of claim 1, wherein the wastewater comprises pesticides.

Claim 13 (withdrawn): The apparatus of claim 1, wherein the wastewater comprises fertilizers.

Claim 14 (withdrawn): The apparatus of claim 1, wherein the wastewater comprises heavy metals.

Claim 15 (withdrawn): The apparatus of claim 1, wherein the wastewater comprises microorganisms.

Claim 16 (withdrawn): The apparatus of claim 1, wherein the treatment gas comprises air.

Claim 17 (withdrawn): The apparatus of claim 1, wherein the treatment gas comprises oxygen.

Claim 18 (withdrawn): The apparatus of claim 1, wherein the treatment gas comprises ozone.

Claim 19 (withdrawn): The apparatus of claim 1, wherein the treatment gas comprises hydrogen.

Claim 20 (withdrawn): The apparatus of claim 1, wherein the treatment gas comprises chlorine.

Claim 21 (withdrawn): The apparatus of claim 1, wherein the treatment gas comprises carbon monoxide.

Claim 22 (withdrawn): The apparatus of claim 1, wherein the gas-enriched fluid is approximately gas-saturated by the treatment gas.

Claim 23 (withdrawn): The apparatus of claim 1, wherein the gas-enriched fluid is gas-supersaturated by the treatment gas.

Claim 24 (withdrawn): The apparatus of claim 1, wherein the gas-enrichment assembly is configured for substantially dissolving the treatment gas into the wastewater to a desired gas content, the desired gas content generally increasing with an operating pressure of the gas-enrichment assembly.

Claim 25 (withdrawn): The apparatus of claim 24, wherein the desired gas content ranges from approximately 275 to 880 ppm for operating pressures of approximately 100 to 300 psi.

Claim 26 (withdrawn): The apparatus of claim 25, wherein the treatment gas comprises oxygen.

Claim 27 (withdrawn): The apparatus of claim 1, wherein the gas-enrichment assembly comprises: a pressurizable chamber having a gas inlet and a gas-enriched fluid outlet; and an atomizer assembly disposed within the pressurizable chamber, the atomizer assembly configured for receiving the wastewater and for atomizing the wastewater into the pressurizable chamber.

Claim 28 (withdrawn): The apparatus of claim 27, wherein the atomizer assembly comprises: a stinger assembly having a conduit adapted to carry the wastewater, and at least one nozzle operatively coupled to the conduit to atomize the wastewater into the pressurizable chamber.

Claim 29 (withdrawn): The apparatus of claim 27, wherein the atomizer assembly comprises: at least one nozzle disposed adjacent an inner wall of the pressurizable chamber, the nozzle configured for atomizing the wastewater into the pressurizable chamber.

Claim 30 (original): The apparatus of claim 1, wherein the delivery assembly comprises: a fluid conduit; and a nozzle coupled to the fluid conduit.

Claim 31 (withdrawn): The apparatus of claim 30, wherein the fluid conduit comprises a hose.

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Claim 32 (withdrawn): The apparatus of claim 30, wherein the nozzle comprises a plurality of fluid passageways configured to expel the gas-enriched fluid in a substantially bubble-free manner.

Claim 33 (withdrawn): The apparatus of claim 32, wherein the fluid passageways have cross-sectional areas and lengths that are adapted to provide a laminar flow and to substantially preserve a dissolved gas content of the treatment gas in the gas-enriched fluid, while preventing excess clogging of the fluid passageways.

Claim 34 (withdrawn): The apparatus of claim 32, wherein the fluid passageways comprise cylindrical conduits having a length of approximately 1.5 inches and a diameter of approximately 0.005 inches.

Claim 35 (withdrawn): The apparatus of claim 30, wherein the nozzle comprises: a plurality of stacked plates defining a plurality of fluid channels therebetween, the fluid channels having an inlet fluidically coupled to the fluid conduit and having an outlet for expelling the gas-enriched fluid.

Claim 36 (withdrawn): The apparatus of claim 35, wherein the stacked plates comprise a substantially flat section.

Claim 37 (withdrawn): The apparatus of claim 35, wherein the stacked plates comprise a substantially conical section.

Claim 38 (original): The apparatus of claim 30, wherein the nozzle comprises: a plurality of capillaries, each of the capillaries having an inlet fluidically coupled to the fluid conduit and having an outlet for expelling the gas-enriched fluid.

Claim 39 (original): The apparatus of claim 38, wherein the capillaries have an inner diameter of approximately 150 to 450 microns.

Claim 40 (original): The apparatus of claim 38, wherein the capillaries are grouped into a plurality of capillary bundles.

Claim 41 (original): The apparatus of claim 40, wherein the capillary bundles comprise a bonding material disposed about the capillary bundles.

Claim 42 (withdrawn): The apparatus of claim 1, comprising at least one filter assembly coupled to the gas-enrichment assembly.

Claim 43 (withdrawn): The apparatus of claim 42, wherein the filter assembly comprises a series of increasingly fine filters.

Claim 44 (withdrawn): The apparatus of claim 42, wherein the filter assembly comprises a 150 micron filter.

Claim 45 (withdrawn): The apparatus of claim 42, wherein the filter assembly comprises a self-cleaning filter.

Claim 46 (withdrawn): The apparatus of claim 42, wherein the filter assembly is disposed between the gas-enrichment assembly and a wastewater inlet.

Claim 47 (withdrawn): The apparatus of claim 42, wherein the filter assembly is fluidically coupled to the delivery assembly for filtering the gas-enriched fluid.

Claim 48 (withdrawn): The apparatus of claim 1, comprising a control system coupled to the gas-enrichment assembly and coupled to the delivery assembly, the control system at least providing control of a wastewater flowrate and a treatment gas flowrate entering the gas-enrichment assembly, and control of a gas-enriched wastewater flowrate exiting the gas-enrichment assembly through the delivery assembly.

Claims 49-62 (canceled)

Claim 63 (currently amended): A wastewater treatment facility comprising:

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a gas-enrichment assembly adapted to receive a supply of wastewater and a supply of treatment gas, wherein the gas-enrichment assembly is configured to gas-enrich the wastewater to a desired content of the treatment gas in a substantially bubble free manner to generate a gas-enriched wastewater; and a delivery assembly coupled to the gas-enrichment assembly to receive the gas-enriched wastewater from the gas-enrichment assembly and in having a fluid communication with untreated wastewater that allows to expels the gas-enriched wastewater into untreated wastewater in a substantially bubble-free manner and capable of raising the concentration of the treatment gas in the untreated wastewater to hyperbaric levels; ~~wherein the delivery assembly is configured to substantially preserve the desired gas content in the gas-enriched wastewater.~~

Claim 64 (original): The facility of claim 63, comprising a mounting assembly configured to support the gas-enrichment assembly and the delivery assembly.

Claim 65 (original): The facility of claim 64, wherein the mounting assembly is configured for fixed mounting at a stationary wastewater treatment site.

Claim 66 (original): The facility of claim 64, wherein the mounting assembly is configured to be coupled to a mobile deployment system.

Claim 67 (original): The facility of claim 66, wherein the mobile deployment comprises a motor driven vehicle.

Claim 68 (original): The facility of claim 66, wherein the mobile deployment system comprises a trailer configured for towing behind a motor driven vehicle.

Claim 69 (original): The facility of claim 66, wherein the mobile deployment system comprises a at least one cart.

Claim 70 (withdrawn): The facility of claim 63, comprising a treatment gas supply configured to provide treatment gas for the gas-enrichment assembly.

Claim 71 (withdrawn): The facility of claim 63, wherein the gas-enrichment assembly comprises:

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a pressurizable chamber having a gas inlet and a gas-enriched fluid outlet; and
an atomizer assembly disposed within the pressurizable chamber, the atomizer assembly configured for receiving the wastewater and for atomizing the wastewater into the pressurizable chamber.

Claim 72 (withdrawn): The facility of claim 63, wherein the delivery assembly comprises:
a fluid conduit; and
a nozzle coupled to the fluid conduit.

Claim 73 (withdrawn): The facility of claim 66, wherein the nozzle comprises a plurality of fluid passageways configured to expel the wastewater, at the desired gas content, in a substantially bubble-free manner.

Claim 74 (withdrawn): The facility of claim 63, comprising at least one filter assembly for filtering the wastewater.

Claim 75 (withdrawn): The facility of claim 63, comprising a control system coupled to the gas-enrichment assembly and coupled to the delivery assembly, the control system at least providing control of the desired gas content and control of an exit flowrate of wastewater expelled through the delivery assembly.

Claim 76 (previously presented): The apparatus of claim 1, wherein the delivery assembly is fluidly connected to the wastewater in such a way that allows a transfer of the treatment gas from the gas-enriched fluid to the wastewater.

Claim 77 (previously presented): The wastewater treatment facility of claim 63, wherein the delivery assembly is fluidly connected to the untreated wastewater in such a way that allows a transfer of the treatment gas from the gas-enriched wastewater to the untreated wastewater.

Claim 78 (previously presented): An apparatus for treating a wastewater comprising:
a gas-enrichment assembly adapted to receive the wastewater and a treatment gas, wherein the gas-enrichment assembly is configured to generate a gas-enriched fluid; and

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a delivery assembly coupled to the gas-enrichment assembly for receiving the gas-enriched fluid from the gas-enrichment assembly, the delivery assembly expelling the gas-enriched fluid in a substantially bubble-free manner, the delivery assembly comprising a fluid conduit and a nozzle coupled to the fluid conduit, wherein the nozzle comprises:

a plurality of capillaries grouped into a plurality of capillary bundles, each of the capillaries having an inlet fluidically coupled to the fluid conduit and having an outlet for expelling the gas-enriched fluid,

wherein the capillary bundles comprise a bonding material disposed about the capillary bundles.

Claim 79 (new): An apparatus for treating a wastewater comprising:

a gas-enrichment assembly adapted to receive the wastewater and a treatment gas, wherein the gas-enrichment assembly is configured to generate a gas-enriched fluid; and

a delivery assembly coupled to the gas-enrichment assembly for receiving the gas-enriched fluid from the gas-enrichment assembly and in fluid communication with the wastewater, the delivery assembly expelling the gas-enriched fluid in a substantially bubble-free manner into the wastewater, the delivery assembly comprising a fluid conduit and a nozzle coupled to the fluid conduit, wherein the nozzle comprises:

a plurality of capillaries grouped into a plurality of capillary bundles, each of the capillaries having an inlet fluidically coupled to the fluid conduit and having an outlet for expelling the gas-enriched fluid.